Wapogasset and Bear Trap lakes
Fisheries Assessment, 2013-2014
Polk County, WI
(MWBIC: 2618000; 2618100)

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Executive Summary

Wapogasset and Bear Trap lakes were surveyed in 2013-2014 to assess the abundance and population demographics (i.e., size and age structure, growth, and recruitment) of sport fish and make comparisons with previous surveys. The adult walleye population could not be estimated due to poor catch in 2013 which was attributed to a late spring. However, based on the fyke net catch rates it appears the walleye population has declined since 2007 when the walleye density was 1.3 fish/acre. These lakes are stocking-dependent walleye lakes and the stockings have previously consisted of fry and small fingerling stockings which have had low levels of contribution to the walleye fishery. Beginning in 2014, Wapogasset and Bear Trap lakes started getting stocked with 15 large fingerling walleye per acre on an alternate-year basis. An assessment on the walleye population and the stocking efficacy of large fingerling walleye will be made during the next comprehensive survey. The first adult muskellunge population survey was completed for these lakes. The muskellunge population was estimated to be 284 fish (95% CI: 209-359) or 0.20 fish/acre. The muskellunge population has increased since the 2007 survey and there is a wide range of age and size classes. The muskellunge fishery should be managed at a moderate density (0.2 to 0.3 adult fish/acre) with high size structure. To achieve this density, the muskellunge stocking regime (i.e., 0.5 fish/acre on an alternate year basis) should also be applied to Bear Trap Lake. The growth rates and size structure of the largemouth bass population has continued to decline from the 1993 and 2007 fisheries surveys. Currently, the largemouth bass fishery is managed with the statewide 14 in minimum length limit bass regulation. A regulation change to increase harvest of bass less than 14 in is recommended. Such a regulation should decrease intraspecific competition and increase growth rates, size structure, and overall quality of the largemouth bass population. Desirable panfish populations with good growth rates and size structure are present in Wapogasset and Bear Trap lakes. Panfish populations are expected to remain respectable as these are productive waterbodies with high predator densities.

Introduction

Wapogasset and Bear Trap lakes are connected lakes located in south-central Polk County, west of Amery, Wisconsin. Wapogasset Lake is a 1,186-acre drainage lake and Bear Trap Lake is a 241-acre lake directly connected to the southern portion of Wapogasset Lake (Figure 1). The two lakes can effectively be thought as one lake with two different basins, as boat navigation and fish passage are unrestricted between the two lakes. Wapogasset Lake has a maximum depth of 32 feet, whereas Bear Trap Lake is slightly less at 25 feet. The lakes have 13.4 miles of shoreline. Much of the shoreline is extensively developed with permanent houses and cabins; however, there is a YMCA camp and bible camp on the east side of Wapogasset Lake that have relatively undisturbed shorelines.

There are two inlets that flow into Wapogasset Lake, Balsam Branch and Friday Creek. Balsam Branch is the larger of the two inlets, and contributes much of the water budget for the lakes. The outlet of Wapogasset Lake is on the southwest side of the lake and is raised by a dam with 2-3 feet of head. The outlet is named Wapogasset Branch and it flows south and drains into the Apple River.

The lakes have a diverse fish community that are comprised of walleye *Sander vitreus*, muskellunge *Esox masquinongy*, northern pike *Esox lucius*, largemouth bass *Micropterus salmoides*, smallmouth bass *Micropterus dolomieu*, bluegill *Lepomis macrochirus*, black crappie *Pomoxis nigromaculatus*, pumpkinseed *Lepomis gibbosus*, white bass *Morone chrysops*, green sunfish *Lepomis cyanellus*, warmouth *Lepomis gulosus*, yellow perch *Perca flavescens*, rock bass *Ambloplites rupestris*, common carp *Cyprinus carpio*, bowfin *Amia calva*, white sucker *Catostomus commersoni*, redhorse species *Moxostoma spp*., and bullheads *Ameiurus spp*.

Walleye have been the most stocked species into Wapogasset and Bear Trap lakes (Table 1). Walleye are not native to either of the two lakes (Becker 1938), but were first stocked into Wapogasset Lake in 1938. Walleye stockings in recent history have consisted of alternate year stocking of small fingerling (<3 in) walleye at an average combined density (i.e., between the two lakes) of 47.3 fish per acre (SE=5.0). The small fingerling stockings have been joint efforts between the WDNR and St. Croix Tribe. There have also been periodic walleye fry stockings in addition to the small fingerling

stockings. Wapogasset and Bear Trap lakes began receiving large fingerling (6-8 in) walleye fingerlings at a combined rate of 15 fish per acre in 2014.

Although muskellunge are not native to Wapogasset and Bear Trap lakes (Becker 1938), they have long been present due to emigration from an upstream lake (Deer Lake) and a downstream river (Apple River), both of which contain muskellunge. Large fingerling muskellunge were first stocked into Wapogasset Lake in 2005. These stockings occurred at a density of 0.5 fish/acre for Wapogasset Lake to maintain a fishable population following the reduction in muskellunge stocking in upstream waters (i.e., Deer Lake; Benike 2009).

Anglers have access to Wapogasset and Bear Trap lakes by two public boat landings on the west shore of Wapogasset Lake and one public boat landing on the southwest shore of Bear Trap Lake. All fishing regulations in the two lakes follow the Wisconsin statewide fishing regulations.

During the most recent comprehensive survey in 2007, the fishery was characterized as having a fair walleye population (P.E. = 1.3 adult fish/acre) with a combined (recreational and tribal) annual exploitation rate of 23.5%, a high density largemouth bass population (8.7 fish/acre), and desirable panfish and northern pike fisheries. Management recommendations included maintaining a high stocking density of small fingerling walleye, attempting a temporary smallmouth bass stocking program, and future monitoring of the largemouth bass fishery to prevent a high density, low size structure population from developing.

The objectives of this survey were to assess the abundance and population demographics (i.e., size and age structure, growth, and recruitment) of sport fish in Wapogasset and Bear Trap lakes and make comparisons with previous surveys.

Methods

Field Sampling:

The sport fish populations in Wapogasset and Bear Trap lakes were sampled in 2013 with early spring fyke netting, late spring AC electrofishing, fall AC electrofishing, and 2014 early spring fyke netting (Table 2).

Fyke nets were set at ice out for the early spring fyke netting surveys. Fyke nets were set May 6 and checked every 24-h for eleven days in 2013, and set on April 28 and checked every 24-h for eight days in 2014. Fyke nets had 4 x 6 ft. frames, 0.5 to 0.75-in bar measure mesh, and lead lengths of 75 or 100 ft.

All gamefish collected in fyke nets in 2013 were measured to the nearest 0.5-in TL and were marked by clipping the left pelvic fin. All fish used for age and growth analyses were measured to the nearest 0.1 in TL. Walleye and muskellunge were the only species measured during the 2014 fyke netting survey. The sex of walleye and northern pike were determined by extrusion of eggs or milt (Cichosz 2013). Aging structures and weights were collected from five walleye and northern pike of each sex per 0.5-in length group. Scales were taken from walleye <12 in and dorsal spines were taken from fish ≥12.0 in. Scales and pelvic fin rays were taken from northern pike. Aging structures were collected from five largemouth bass per 0.5-in length group; scales were taken from largemouth bass <12 in and dorsal spines were collected from largemouth bass ≥12 in.

A mark-recapture population estimate of adult (≥15 in) walleye was attempted using early spring fyke netting and early spring electrofishing during 2013. However, catch of walleye was poor during the 2013 fyke netting survey, likely attributed to the condensed spawning period due to the unusually late spring. Therefore, we could not estimate the walleye population so the catch rate of walleye was indexed using catch per effort (CPE) data.

The population abundance of adult (≥30 in) muskellunge for Wapogasset and Bear Trap lakes combined was estimated using mark and recapture methodology. Muskellunge surveys are two-year netting surveys, so 2013 served as the marking year and 2014 was the recapture year. The sex of captured fish was determined by presence of eggs or milt or by visual inspection of the urogenital pore as described by LeBeau and Pageau (1989). Each muskellunge was measured to the nearest 0.1 in total length. Aging structures (scales and anal fin rays) and weights (to the nearest 0.1 lb) were taken from five fish per 0.5 in length group of each sex in 2013. All muskellunge ≥30 in were marked in 2013 by removing half the left pelvic fin with a scissors. Fish <30 in were marked by removing the right pelvic fin. Fish were checked for marks during the

recapture event in 2014. To prevent double-counting fish, all fish handled in 2014 were marked by clipping the top corner of the caudal fin. Abundance of adult muskellunge was estimated using Chapman's modification of the Petersen single-census method (Ricker 1975):

$$N = \frac{(M + 1)(C + 1)}{(R + 1)} - 1$$

where N = population estimate; M = the number of fish marked in the first (marking) sample; C = the total number of fish (marked and unmarked) captured in the second (recapture) sample; and R is the number of marked fish captured in the second sample.

The number of muskellunge collected in 2014 was adjusted for recruitment over a 1-year period. For this, all females less than 32 in, and males less than 31 in captured in 2014 were excluded from analyses because they were assumed to have been less than 30 in during the 2013 marking event. These lengths were determined from recapture data; that is to say, all males recaptured in 2014 were at least 31 in and recaptured females were at least 32 in. Several independent abundance estimates were calculated: 1) adult muskellunge ≥30 in; and 2) all muskellunge 30.0-33.9 in, 34.0-37.9 in, 38.0 in and greater, and 40.0 in and greater.

Largemouth bass and panfish were assessed by AC boat electrofishing at night along the shoreline in late spring with two dip-netters. Wapogasset Lake was surveyed on June 5, 2013 and Bear Trap Lake was surveyed on May 23, 2013. The combined sampling effort was five 1.5-mile gamefish transects in which only gamefish were collected, and five 0.5-mile index transects in which all species were collected. Weights and scale samples were collected from five fish per 0.5-in length group for age and growth analysis. Dorsal spines were taken from largemouth bass and walleye ≥12 in.

The year class strength of age-0 walleye was assessed with fall boat AC electrofishing at night with two dip-netters. The entire shoreline was sampled and all walleye were netted. Scale samples were collected from walleye <12 in. The catch per effort (CPE) of age-0 walleye shocking was determined by catch per mile and compared to previous fall evaluations. Historic fall electrofishing surveys during 1988-2013 were used to assess walleye stocking efficacy and to document natural reproduction in non-stocked years.

Population Demographics:

Scale samples were pressed on acetate slides and age was assessed on a microfiche reader by a single interpreter. Dorsal spines were mounted in plastic, cut with a Dremel saw and age interpreted on a microfiche reader by a single interpreter. Muskellunge anal fin rays were cut with a Dremel saw and aged under a dissecting microscope with side illumination from a fiber optic light.

Mean length-at-age comparisons were made with the 2007 survey, the Barron and Polk County averages, and the regional (18 county WDNR Northern Region) averages obtained from the WDNR Fisheries and Habitat database.

The von Bertalanffy (1938) growth model was fitted using mean length at age data to assess growth for walleye and muskellunge using the following equation:

$$L_t = L_{inf} (1\text{-}e^{-k(t-t0)})$$

*Where L_t is length at time t, L_{inf} is the maximum theoretical length (length infinity), **e** is the exponent for natural logarithms, k is the growth coefficient, t is age in years, and t_0 is the age when L_t is zero.*

Growth equations were calculated separately for each sex due to sex-specific growth differences.

Instantaneous mortality (Z) and annual mortality ($A = 1\text{-}e^{-Z}$) estimates were calculated for all species using a catch curve regression fitted to those ages fully recruited to the gear (Miranda and Bettoli 2007).

Proportional size distribution (PSD) indices were used to describe population size structure of walleye, muskellunge, northern pike, largemouth bass, and bluegill (Guy et al. 2007). PSD values represent the percent of fish stock length or longer that are also longer than a specified length (Appendix Table 1). The Fisheries Assessment Classification Tool (FACT) was used to determine how PSD values for largemouth bass and walleye compared to those from similar waterbodies throughout Wisconsin. In addition, the CPE for 8, 12, and 15 in (i.e., CPE8, CPE12, and CPE 15) largemouth bass were compared to similar waterbodies in Wisconsin. Relative Weight (*Wr*) was used to assess the condition level of all gamefish species using the standard weight equations for each species (Anderson and Neumann 1996). Relative weight is the ratio of a fish's weight to the weight of a ''standard'' fish of the same length times 100.

Results

Early spring fyke netting

Sampling effort included 120 net-nights of fyke netting in Wapogasset Lake and 32 net-nights in Bear Trap Lake in 2013. Similarly, we expended 99 net-nights of fyke netting in Wapogasset Lake and 18 net-nights of effort in Bear Trap Lake in 2014 (Table 2).

Walleye. The walleye catch rate was 0.63 fish/net-night for Wapogaset Lake and 0.06 fish/net-night for Bear Trap Lake during 2013. The walleye catch rate in 2014 was 1.39 fish/net-night in Wapogasset and 0.28 fish/net-night in Bear Trap Lake. Seventy seven walleyes were collected in fyke nets in 2013 and 139 in 2014, which resulted in 216 walleye between years (Figure 2). The catch rate of walleye decreased since the 2007 survey when it was 10.6 fish/net-night and 0.50 fish/net-night in Bear Trap. We collected 80 males, 108 females, and 4 walleyes of unknown sex that were 15-in TL or greater. The male: female ratio was 1:1.4.

Walleye size structure and condition were high. Walleye PSD (2013 and 2014 pooled) from netting was 83 and the PSD-P was 62 (Figure 3). PSD and PSD-P values were greater than those from previous netting surveys. When compared to statewide trends, walleye PSD was in the 43rd percentile and PSD-P was in the 97th percentile. Mean length of walleye (sexes pooled) from fyke netting was 21.1 in (SE=0.35). The mean length of male walleye was 17.0 in (SE=0.43) and mean length of female walleye was 24.0 in (SE=0.29). Walleye *Wr* was 88.

Walleye in Wapogasset and Bear Trap lakes had fast growth rates. Mean length at age for walleye (sexes pooled) was greater than the Barron and Polk County average for all but one age (age 13), and was greater than the Northern Region average across all ages (Table 3). Walleye growth rates appear to have increased since the 2007 survey, as mean length at age of walleye in this survey was greater across nearly all ages. Mean length at age of female walleye was greater than male walleye across all ages. The predicted length infinity (L_{inf}) from the von Bertalanffy growth model was 27.3 in for female walleye, and 22.7 in for male walleye (Figure 4).

Walleye ages ranged from 1 to 15, male walleye ranged from age 2 to 14 and females ranged from 3 to 15. A realistic mortality estimate could not be obtained from the catch curve regression model.

Muskellunge. We marked 107 adult (>30 in) muskellunge (51 males and 56 females) in 2013, of which, 32 (20 males and 12 females) were recaptured in 2014. There were also 54 unmarked adult muskellunge (18 males, 35 females, 1 unknown sex) collected in 2014 (Figure 5). The adult (≥ 30 in) muskellunge population estimate was 284 fish (95% CI: 209-359) and the density estimate was 0.20 adult fish/acre. Population estimates by length group for 2013 were: 56 from 30.0-33.9 in; 90 from 34.0-37.9 in; 127 greater than 38 in; and 107 greater than 40 in (Table 4).

Mean length of male muskellunge was 34.4 in (SE=0.42), mean length of female muskellunge was 39.6 in (SE=0.44), and the mean length for muskellunge (sexes pooled) was 37.1 in (SE=0.36).

Adult muskellunge collected in this survey were in good condition. The mean *Wr* was 104 (SE=0.70). The predicted length infinity (L_{inf}) from the von Bertalanffy growth model was 50.7 in for female muskellunge, and 42.9 in for male muskellunge (Figure 6). Proportional size distribution indices indicated good size structure. Muskellunge PSD was 90, PSD-P was 43, PSD-M was 18, and PSD-T was 1.

Since this is the first muskellunge population estimate conducted on Wapogasset and Bear Trap lakes, there is no comparable data from previous surveys. However, it appears the muskellunge population has improved because the catch rates of muskellunge have increased since the 2007 survey. The catch per effort of muskellunge in this survey (2013 and 2014 pooled) was 0.89 fish/net-night in Wapogasset Lake and 0.36 fish/net-night in Bear Trap. In comparison, the catch rate of muskellunge in the 2007 survey was 0.10 fish/net-night in Wapogasset Lake and 0.05 fish/ net-night in Bear Trap Lake.

Northern Pike. Catch of northern pike was relatively low. There were 40 northern pike collected during the spring 2013 fyke netting survey (Figure 7). There were 30 northern pike captured in Wapogasset Lake for a catch rate of 0.25 fish/net-night, and 10 northern pike were captured in Bear Trap Lake for a catch rate of 0.31 fish/net-night. Catch of

northern pike from both lakes was less than the 2007 survey when 1.89 fish/net-night in Wapogasset and 2.15 fish/net-night in Bear Trap.

The size structure of northern pike was high, likely due to their low abundance. Northern pike PSD from netting was 63 ± 17 and the PSD-P was 20 ± 14 (Figure 8). The PSD and PSD-P have both increased since the 2007 survey when they were 43 ± 8, and 6 ± 4. The current PSD and PSD-P values are the second highest from all previous netting surveys, only 1973 values were higher.

Mean length of northern pike (sexes pooled) from fyke netting was 23.5 in (SE=0.9), northern pike ranged in length from 14.5 to 36.0 in. The mean length of male northern pike was 20.7 in (SE=0.8) and mean length of female northern pike was 26.9 in (SE=1.4). There were 19 males, 18 females, and 2 northern pike of unknown sex. Northern pike *Wr* was 89.

Northern pike had fast growth rates. Mean length at age for northern pike (sexes pooled) were greater than the Barron and Polk County and the Northern Region averages across all ages (Table 5). The von Bertalanffy growth models could not converge.

Northern pike ages ranged from 2 to 8, indicating good survival; however, a mortality rate was not estimated with a catch curve due to low sample size.

Largemouth bass. There were 69 largemouth bass collected during spring 2013 fyke netting on Wapogasset Lake (0.58 fish/net-night) and 57 from Bear Trap Lake (1.78 fish/ net-night; Figure 9). Largemouth bass up to 19.5 inches were collected fyke netting, and the mean length was 11.7 in (SE=0.4).

Late spring electrofishing

Largemouth Bass. Largemouth bass had relatively high abundance and low size structure. There were 400 largemouth bass collected during late spring electrofishing survey (Figure 9); the catch rate was 50 fish/mile on Bear Trap Lake and 37.5 fish/mile on Wapogasset Lake. The overall electrofishing catch rate between the two lakes was 42.1 fish/mile, which is a slight drop from the 2007 survey (52.4 fish/mile). The catch rates from this survey (42.1 fish/mile; 121.2 fish/hour) were a slight decrease from the 2007 survey (52.4 fish/mile; 135.0 fish/hour), which was also conducted during spring.

However, the 2013 catch rate was still considerably greater than all eight surveys prior to 2007.

The catch rates of largemouth bass ≥8 inches were 21.7 fish/mile on Wapogasset and 30.9 fish/mile on Bear Trap, and 25.1 fish/mile for the lakes combined. The catch rates (fish/mile) of largemouth bass ≥8 inches and ≥12 inches were above average when compared to similar waterbodies in Wisconsin. The CPE8 and CPE12 were in the 65th and 58th percentiles, respectively. However, the catch rate of largemouth bass ≥15 (CPE15) inches was well below average and ranked in the 18th percentile.

Largemouth bass PSD was 36, and the PSD-P was 3, both of which have decreased since 2007 (PSD 61 and PSD-P 10; Figure 11). Although the largemouth bass PSD is similar to seven of the nine surveys conducted on Wagogasset since 1973, the largemouth bass PSD was in the 11th percentile for similar waterbodies in Wisconsin. Largemouth bass ranged in length from 5.0 to 15.5in, and the mean length was 9.1 in (SE=0.14). Largemouth bass *Wr* was 97, which suggests the largemouth bass are in average condition.

Growth rates of largemouth bass have decreased since the 2007 survey and are less than the Barron and Polk County average and also the Northern Region average (Table 6). Mean length at age of bass age 5 and older was lower in the 2013 survey compared to the 2007 survey. Mean length at age for age 4 to age 11 were approximately 1 in less (on average) than the Barron and Polk County average and 2 in less (on average) than the Northern Region average.

Largemouth bass were fairly long-lived. Ages of largemouth bass ranged from 1 to 15. The catch curve regression model (fitted to age 2 to age 15) estimated annual mortality to be 31.8% ($Z= -0.38$, $R^2 = 0.89$; Figure 12).

Smallmouth Bass. Only one smallmouth bass was collected during the night electrofishing surveys in the two lakes. It was 10.5 inches.

Bluegill. There were 213 bluegill collected during the late spring electrofishing survey in the two lakes (Figure 13). The catch rate of bluegill was slightly greater in Bear Trap Lake (117 fish/mile) than Wapogasset Lake (64 fish/mile). Overall, the length of

bluegill ranged from 2.5 to 8.5 in, and the mean length was 4.9 in (SE=0.09). Bluegill PSD was 23, which ranked 45th for similar waterbodies in Wisconsin.

The growth rates of bluegill in Wapogasset and Bear Trap lakes were good. The mean length at age of bluegill were similar to the Barron and Polk County and Northern Region averages (Table 7).

Bluegill ages ranged from 1 to 8. A catch curve regression was fitted to ages 3 to 8. The catch curve regression model (fitted to age 3 to age 8) estimated annual mortality to be 55.6% (Z= -0.81, R^2 = 0.89; Figure 14).

Other panfish. There were 13 rockbass collected in the two lakes during the late spring electrofishing for a catch rate of 5.2 fish/mile. The mean length of rockbass was 6.1 in (SE=0.30) with a range of 4.4 to 7.6 in.

Seven pumpkinseeds were sampled, for a catch rate of 2.8 fish/mile. The mean length was 6.1 in (SE=0.46) with a range of 3.7to 7.5 in.

There were four black crappies collected, which resulted in catch per effort of 1.6 fish/mile. The mean length was 7.9 in (SE=0.29) with a range of 7.2 in to 8.5 in.

One 4.5 in yellow perch was sampled for a catch rate of 0.4 fish/mile.

Fall Electrofishing

Age-0 walleye. No age-0 walleye were collected during the 2013 fall electrofishing survey. There were 9 age-1 walleyes collected in Wapogasset Lake for a catch rate of 0.99 fish/mile and 1 age-1 walleye from Bear Trap Lake for a catch rate of 0.29 fish/mile. The age-1 walleye were likely stocked fish from 2012.

Catch rates of age-0 walleye have historically been low in Wapogasset and Bear Trap lakes, even after intensive stocking efforts (Table 8). The walleye fishery in Wapogasset and Bear Trap lakes is a stocked population. Minimal natural reproduction has been documented as evidenced by the lack of age-0 walleye in non-stocked years. The average fall electrofishing catch rates of age-0 walleye from stocked years (mean =1.06; SE=0.29) is greater than the average catch rate during non-stocked years (mean= 0.37; SE=0.22). The average fall catch rate for all years is 0.76 fish/mile (SE= 0.22).

However, the low catch rates of age-0 walleye in stocked years indicates the general survival of small fingerlings and fry has been low.

Of the 16 fall electrofishing surveys that have occurred since 1988, the mean catch rate of age-0 walleye has been 0.76 fish/mile (SE=0.39). This is a very low catch rate, considering from 1990 to 2010 the average fall catch rate of age-0 walleye in the Ceded Territory was 5.7 fish/mile for stocked populations and 31.7 fish/mile in naturally-reproducing populations (Cichosz 2013).

Summary and Discussion

Wapogasset and Bear Trap lakes have diverse and well-rounded fisheries. These two lakes are productive waterbodies that receive extensive angling pressure. Overall, the fishery in these lakes is of high quality for most species present.

The walleye population currently appears to have relatively low abundance, but good size structure. Wapogasset and Bear Trap lakes have historically had lower density walleye populations; this is due to the lack of natural recruitment and dependence upon stocking. Walleye populations in Wapogasset Lake were as high as 1.9 fish/acre in 1987 and were 1.3 fish/acre in 1993 and 2007. Based on the fyke net catch rates it appears the walleye population has declined from 2007; however, the low walleye catch rate in this survey is at least partially because many of our net locations targeted muskellunge once we determined we were not able to conduct a walleye population estimate.

There continues to be a low level of natural reproduction of walleye occurring in Wapogasset and Bear Trap, but not enough to sustain a population. Most walleye stocking in Wapogasset and Bear Trap lakes have been limited to fry and small fingerling stockings. These stockings have had relatively low levels of contribution to the walleye fishery based on the catch rates of age-0 walleye during fall electrofishing surveys. Beginning in 2014, Wapogasset and Bear Trap lakes were selected as lakes to begin getting stocked with 15 large fingerling walleye per acre on an alternate-year basis. Since these lakes form a relatively large and fertile system, the large fingerling walleye stockings should have good survival and hopefully improve the adult walleye population. A better assessment on the walleye population and the stocking efficacy of large

fingerling walleye will be made during the next comprehensive survey scheduled in 2019.

Although muskellunge have long been a part of the fishery in Wapogasset and Bear Trap lakes, this is the first dedicated adult muskellunge population estimate in these lakes. The current muskellunge population has increased since the 2007 survey and there is a range of well-represented age and size classes. This increase in the muskellunge population is largely due to the muskellunge stocking program initiated in 2005. The improvement of the muskellunge fishery has not gone unnoticed. Based on anecdotal evidence from anglers, there has been an increase in the angling effort directed at muskellunge in recent years.

These lakes are capable of producing large muskellunge, as documented in this survey. The muskellunge fishery should be managed at a moderate density with high size structure. The target population level of muskellunge in Wapogasset and Bear Trap lakes should be between 0.2 to 0.3 adult fish/acre. An adult density maintained within this range should be able to maintain high size structure with a respectable population density that would provide good angling action. Currently, these lakes are getting stocked at a rate of 0.5 fish/acre on an alternate year basis for Wapogasset Lake only. The muskellunge stocking rate should also include Bear Trap Lake. The slight increase in muskellunge stocking is not anticipated to affect the fish community in the two lakes. Wapogasset and Bear Trap lakes have a fairly abundant sucker and redhorse populations, which should serve as the primary forage base for the muskellunge population.

Since muskellunge are now actively managed in these two lakes, it is imperative that we conduct muskellunge population estimates during our comprehensive surveys every six years. In addition, since we will be handling more muskellunge during these surveys it is important that we tag all muskellunge (≥20") handled in surveys with passive integrated transponder (PIT) tags. By PIT tagging all muskellunge handled we will be able to obtain better insight on the age, growth, mortality, and general movement patterns of this muskellunge population.

If the muskellunge fishery continues to increase, a muskellunge reclassification of these lakes should be considered during the next muskellunge survey. These lakes are currently listed as Class B muskellunge water, which are known for providing good

muskellunge angling; however, if the population size and size structure continues to increase during the next survey the lakes should be considered as Class A muskellunge waters. Class A muskellunge waters are the premier muskellunge waters considered to provide the best muskellunge fishing.

Catch rates of northern pike have decreased since the 2007, but the size and growth rates of the current northern pike population are excellent. No management changes are warranted and a respectable pike fishery is currently present.

The growth rates and size structure of the largemouth bass population has continued to decline from the 1993 and 2007 fisheries surveys. Although the catch rates had a slight decline in this survey from the 2007, it is felt the lower catch rates during the late spring electrofishing survey were more of an artifact of the cold front we experienced that night, which likely reduced the catch rate of bass, than a reduction in the bass population. Largemouth bass densities were considered high (8.7 fish/acre) in the 2007 survey, although we didn't determine a bass population estimate in this survey, the population could be greater now based on the slower growth rates in this survey. There were larger and older largemouth bass collected during the early spring fyke netting survey, but in general the size structure and growth rates of bass in these lakes is less than desired.

Currently the largemouth bass are managed with the statewide 14 in minimum length limit bass regulation. It is recommended that the harvest of largemouth bass be liberalized, especially for bass less than 14 inches to reduce intraspecific completion and increase growth rates and size structure. Therefore, a no minimum 14-18" protected slot limit and 5 fish daily bag limit or no minimum length limit 5 fish daily bag limit regulations should be considered for these lakes. Largemouth bass receive substantial attention on Wapogasset and Bear Trap lakes. In the most recent creel survey in 2007, largemouth bass received 24.0% of the directed angling effort on Wapogasset Lake and 18.0% of the directed angling effort on Bear Trap Lake. With the overall importance of the bass fishery, the bass regulation should be changed to increase the size structure and overall quality of the bass fishery.

Although there was one smallmouth bass stocking event in 2012, additional smallmouth bass stockings are not recommended at this time. The two lakes have a

remnant population of smallmouth bass. Stocking smallmouth bass would likely only create a stocking-dependent fishery, because the lakes have had smallmouth bass in them for some time and if the lakes could produce noticeable natural smallmouth bass year classes they would have already. In addition, smallmouth bass should not be stocked on top of a high density largemouth bass population, as the two compete for many of the same resources and their diets and growth rates can be correlated (Olson and Young 2003). The smallmouth bass population may potentially improve if the largemouth bass population is reduced. No management action for smallmouth bass is recommended at this time.

Panfish populations in Wapogasset and Bear Trap lakes continue to be in good shape. The bluegill population currently has average growth rates and moderate size structure. Based on the most recent creel survey, bluegill was the most caught and harvested fish in both lakes (Benike 2009). Bluegills are expected to remain in good shape since these are productive waterbodies with high predator densities. Black crappies and yellow perch likely have a larger role in the overall fishery than what our survey indicated. Although they weren't effectively sampled with our sampling gear, Wapogasset and Bear Trap lakes are two of few lakes in the area that have a white bass population.

Management Recommendations

1. Maintain adult walleye density between 1-2 fish/acre through stocking large fingerling (6-8 in) walleyes at a rate of 15 fish/acre. A better assessment will be made on the relative contribution of the large fingerlings during the next comprehensive survey in 2019.
2. Manage muskellunge at a density of 0.2 to 0.3 fish/acre to provide a moderate density population with high size structure. To achieve this, the stocking regime of 0.5 fish per acre on an alternate year basis should also include Bear Trap Lake.
3. Since muskellunge are now actively managed in these lakes, population estimates should now be conducted during each comprehensive survey. In addition, all muskellunge handled during surveys should be PIT-tagged to provide insight on the age, growth, mortality, and general movement patterns of this population.

4. To improve the size structure, growth rates, and overall quality of the largemouth bass population, the regulation should be changed to liberalize harvest of fish less than 14 inches. The possibility of a no minimum length limit, 14-18 in protected slot, 1 over 18 in regulation 5 fish bag limit, or a no minimum length limit should be explored.
5. The entire fish community will be assessed in the next comprehensive fisheries survey which is scheduled for 2019. Special attention should be directed at the abundance and recruitment of walleye; as well as the abundance, size structure, and growth rates of largemouth bass.
6. Encourage lakeshore property owners to minimize disturbance to the lakeshore and littoral zone, to protect both fish and wildlife habitat, and water quality.

Acknowledgements

Special thanks are extended to the Brian Spangler, Josh Kucko, Kim Kuber, and Mark Stanley of the Barron field office with assistance in the field, data entry, and fish age estimation.

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Table 1. Stocking history for Wapogasset and Bear Trap lakes, Polk County, WI, 1975-2014.

Year	Species	Age Class	Number Stocked
1975	Walleye	Fingerling	50,014
1977	Walleye	Fingerling	53,137
1979	Walleye	Fingerling	71,516
1981	Walleye	Fingerling	71,490
1983	Walleye	Fingerling	71,958
	Walleye	Fry	3,457,000
1985	Walleye	Fingerling	71,540
1987	Walleye	Fingerling	27,864
1988	Walleye	Fingerling	62,243
	Walleye	Fry	1,713,641
1989	Walleye	Fry	900,000
1990	Walleye	Fingerling	61,056
1992	Walleye	Fingerling	63,192
1994	Walleye	Fingerling	82,622
1996	Walleye	Fingerling	58,359
1998	Walleye	Small Fingerling	63,446
2000	Walleye	Small Fingerling	106,950
	Walleye	Large Fingerling	4,413
2002	Walleye	Small Fingerling	168,731
	Walleye	Large Fingerling	37
2004	Walleye	Small Fingerling	115,106
2005	Walleye	Fry	3,700,000
	Muskellunge	Large Fingerling	711
2006	Walleye	Small Fingerling	41,485
2007	Muskellunge	Large Fingerling	395
2008	Walleye	Small Fingerling	50,169
2009	Muskellunge	Large Fingerling	593
	Walleye	Small Fingerling	11,040
2010	Walleye	Small Fingerling	49,945
2011	Muskellunge	Large Fingerling	593
2012	Smallmouth Bass	Large Fingerling	4,264
	Walleye	Small Fingerling	66,073
2014	Walleye	Small Fingerling	33,721
	Walleye	Large Fingerling	21,509

Table 2. Sampling effort for the 2013-2014 Wapogasset Lake and Bear Trap Lake comprehensive fisheries surveys.

Lake	Date	Gear	Survey type	Effort
Wapogasset Lake	5/6/2013 to 5/17/2013	Fyke nets	Walleye & Muskellunge netting	120 net-nights
Bear Trap Lake	5/6/2013 to 5/14/2013	Fyke nets	Walleye & Muskellunge netting	32 net-nights
Bear Trap Lake	05/23/2013	AC Electrofishing	Bass-Panfish electrofishing	3.5 miles
Wapogasset Lake	06/05/2013	AC Electrofishing	Bass-Panfish electrofishing	6.0 miles
Wapogasset Lake	10/09/2013	AC Electrofishing	Age-0 walleye electrofishing	9.9 miles
Bear Trap Lake	10/10/2013	AC Electrofishing	Age-0 walleye electrofishing	3.5 miles
Wapogasset Lake	04/28/2014 to 5/6/2014	Fyke nets	Walleye & Muskellunge netting	88 net-nights
Bear Trap Lake	04/28/2014 to 5/6/2015	Fyke nets	Walleye & Muskellunge netting	18 net-nights

Table 3. Mean length (in) at age for walleye (sexes pooled) in Wapogasset and Bear Trap lakes, from the 2013-2014, 2007 surveys, the Barron and Polk County average, and the northern Wisconsin average. Standard errors are listed in parentheses.

Age	2013-2014	2007	Barron & Polk avg	Northern WI avg
1	7.7 (0.16)	—	7.5 (0.15)	6.4
2	12.6 (0.68)	10.9 (0.15)	10.9 (0.13)	9.5
3	14.4 (0.63)	14.1 (0.22)	13.9 (0.16)	11.7
4	19.3 (0.40)	15.3 (0.28)	15.6 (0.16)	13.8
5	20.4 (0.69)	18.6 (0.29)	17.7 (0.19)	15.8
6	—	19.1 (0.52)	19 (0.17)	17.5
7	24.1 (0.75)	20.3 (0.49)	20.8 (0.19)	19.1
8	22.3 (1.51)	23.9 (0.97)	21.8 (0.23)	20.5
9	23.4 (0.62)	21.8 (0.50)	22.5 (0.22)	21.6
10	23.9 (0.71)	21.8 (0.73)	23.3 (0.26)	22.7
11	25.3 (0.82)	22.6 (0.99)	23.9 (0.26)	23.7
12	27.1 (0.39)	23.3 (4.15)	25.0 (0.39)	24.4
13	24.6 (1.06)	23.2 (1.43)	25.2 (0.42)	25.2
14	26.8 (0.69)	20.1 (0.50)	24.8 (0.51)	25.8
15	28.8 (0.25)	23.1 (1.07)	25.6 (0.49)	25.6

Table 4. Abundance estimates of adult muskellunge by length-group for Wapogasset and Bear Trap lakes, Polk County, Wisconsin 2013-2014. Coefficient of variation (CV = 100 X SD/mean) is in parenthesis.

Length-group (in)	30-33.9	34-37.9	≥38.0	≥40.0
Estimate (CV)	56 (30.15)	90 (22.12)	127 (17.77)	107 (21.19)

Table 5. Mean length (in) at age for northern pike (sexes pooled) in Wapogasset and Bear Trap lakes, from the 2013 survey, the Barron and Polk County average, and the northern Wisconsin average. Standard errors are listed in parentheses

Age	2013	Barron & Polk avg.	Northern Region
1	—	10.8 (0.38)	11.2
2	18.6 (0.95)	15.9 (0.34)	14.1
3	19.6 (0.56)	19.6 (0.34)	17.4
4	25 (0.91)	21.4 (0.28)	20.0
5	25.7 (1.52)	24.2 (0.48)	22.7
6	29 (2.89)	26.5 (0.63)	24.5
7	—	28.9 (0.76)	27.3
8	35.3 (-)	32.1 (0.80)	30.3

Table 6. Mean length (in) at age for largemouth bass in Wapogasset and Bear Trap lakes, from the 2013 and 2007 comprehensive surveys, the Barron and Polk County average, and the northern Wisconsin average. Standard errors are listed in parentheses.

Age	2013	2007	Barron & Polk avg.	Northern Region
1	4.3 (0.09)	4.0 (-)	4.2 (0.13)	4.7
2	6.6 (0.12)	6.4 (0.17)	6.8 (0.11)	6.7
3	8.8 (0.17)	8.7 (0.13)	8.9 (0.11)	9.0
4	10.2 (0.30)	10.1 (0.26)	10.9 (0.12)	11.0
5	11.8 (0.39)	12.0 (0.19)	12.5 (0.12)	12.7
6	12.3 (0.24)	13.6 (0.17)	13.9 (0.13)	14.6
7	13.6 (0.17)	15.4 (0.18)	14.9 (0.13)	16.0
8	14.7 (0.17)	16.7 (0.21)	16.0 (0.14)	17.3
9	15.3 (0.30)	17.6 (0.29)	17.0 (0.17)	18.1
10	17.0 (0.30)	—	17.5 (0.22)	18.8
11	17.4 (0.19)	—	18.5 (0.23)	19.4
12	19.3 (0.48)	—	18.7 (0.26)	19.6
13	—	—	19.4 (0.63)	19.4
14	—	—	19.7 (0.41)	20.2
15	19.6 (-)	—	20.0 (0.42)	—

Table 7. Mean length (in) at age for bluegill in Wapogasset and Bear Trap lakes, from the 2013 surveys, the Barron and Polk County average, and the northern Wisconsin average. Standard errors are listed in parentheses.

Age	2013	Barron & Polk avg.	Northern Region
1	2.8 (0.45)	2.3 (0.1)	3.0
2	2.7 (0.1)	3.4 (0.07)	3.7
3	4.2 (0.18)	4.3 (0.11)	4.7
4	5.4 (0.27)	5.4 (0.13)	5.6
5	6 (0.21)	6.2 (0.11)	6.4
6	6.9 (0.25)	6.9 (0.11)	6.9
7	8 (0.18)	7.4 (0.12)	7.5
8	8.5 (-)	7.8 (0.14)	7.9

Table 8. Fall electrofishing catch rates of age-0 walleye in Wapogasset and Bear Trap lakes with the number of walleye stocked during years fall surveys were conducted. An asterisk denotes when Wapogasset and Bear Trap lakes were surveyed the same year. All other surveys were Wapogasset Lake surveys only.

Year	Number Stocked	Size Stocked	miles surveyed	Age-0/mile
1988	62,243	Small Fingerling	5.6	0.71
	1,713,641	Fry		
1991	—	—	9.9	0.00
1992	63,192	Small Fingerling	9.9	2.42
1993*	—	—	13.4	0.00
2000	106,950	Small Fingerling	5.6	2.68
	4,413	Large Fingerling		
2001	—	—	5.6	1.61
2002	168,731	Small Fingerling	5.6	0.18
	37	Large Fingerling		
2003	—	—	5.6	0.36
2004*	115,106	Small Fingerling	9.1	0.44
2005	3,700,000	Fry	5.6	0.36
2006	41,485	Small Fingerling	9.1	0.11
2007*	—	—	12.6	0.08
2010	49945	Small Fingerling	5.6	1.07
2011	—	—	5.6	0.54
2012	66,073	Small Fingerling	5.6	1.61
2013*	—	—	12.6	0.00

Figure 1. Map of Wapogasset and Bear Trap lakes, Polk County, Wisconsin.

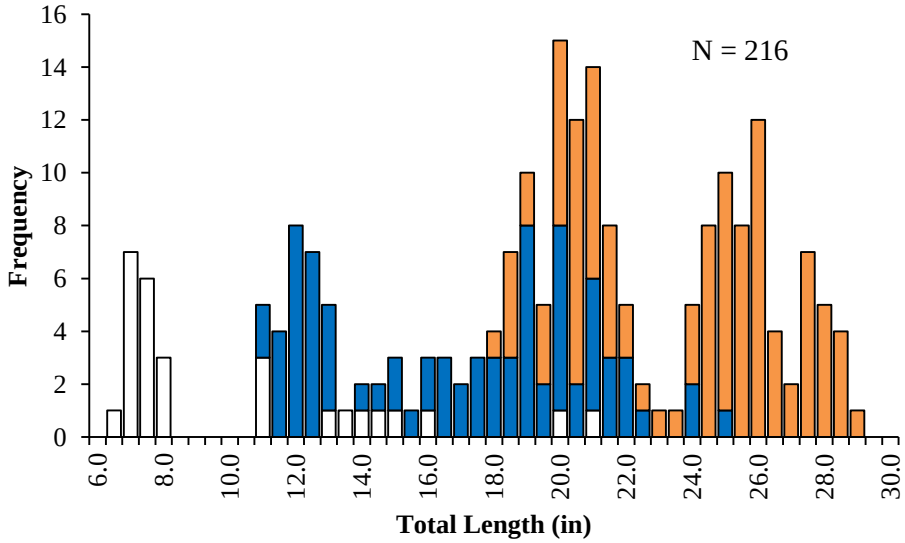

Figure 2. Length frequency histogram for walleye captured with fyke nets in Wapogasset and Bear Trap lakes, Polk County, WI, 2013-2014. White bars represent walleye of unknown sex, blue bars represent male walleye, and orange bars represent female walleye.

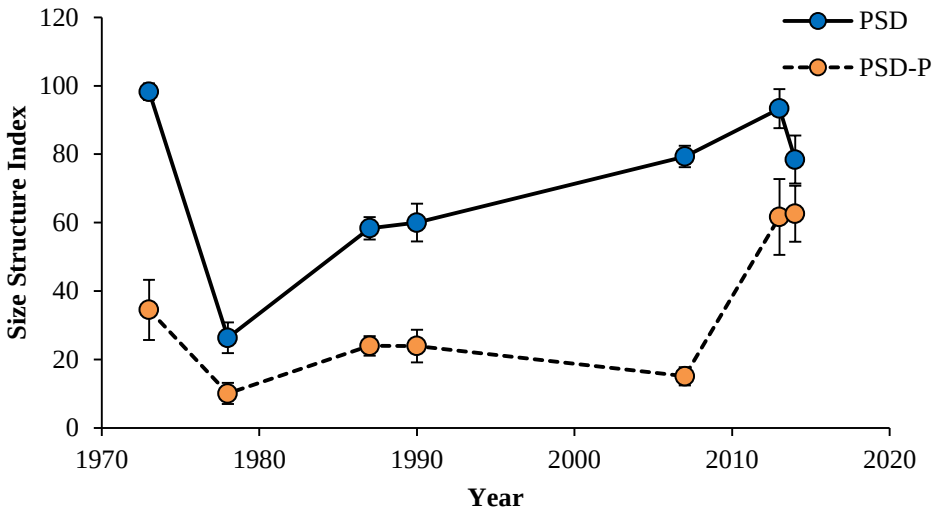

Figure 3. PSD and PSD-P size structure index values (with 95% confidence intervals) for walleye collected from fyke nets Wapogasset and Bear Trap lakes, Polk County, WI, 1973-2013.

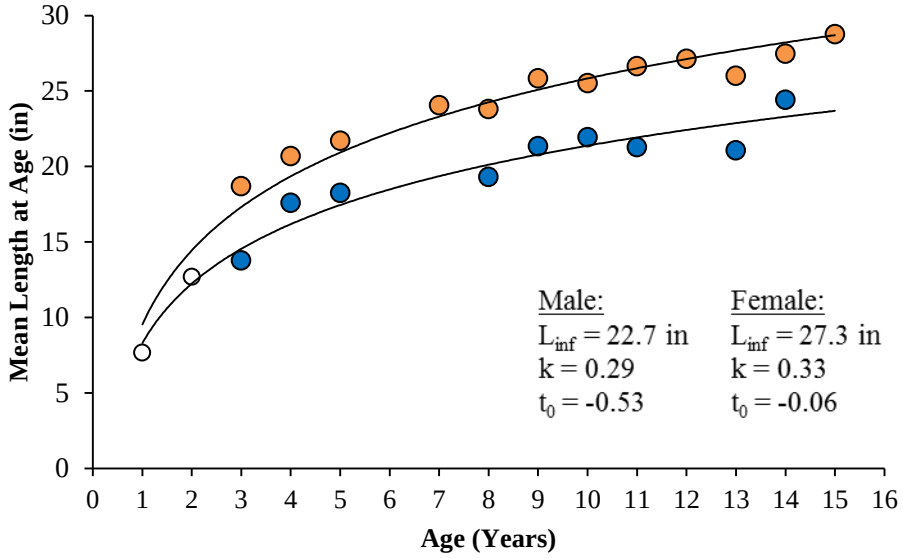

Figure 4. Mean lengths-at-age for female (orange circles), male (blue circles), and unknown sex (white circles) walleye collected from Wapogasset and Bear Trap lakes, Polk County, WI, 2013. Mean length at age of age-1 and age-2 unknown sex walleye were included for the growth equations. L_{inf} = theoretical maximum length, k = growth coefficient, and t_0 = time at which length is zero.

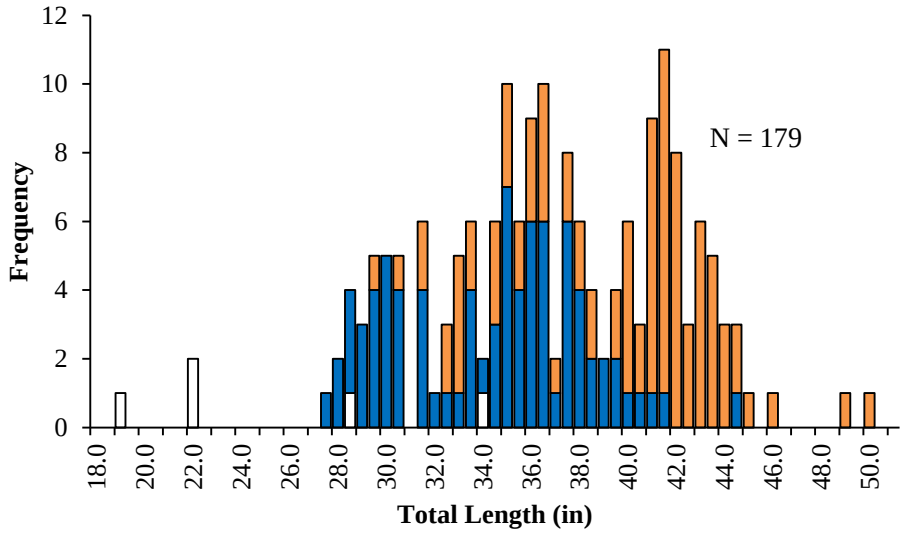

Figure 5. Length frequency histogram for muskellunge captured with fyke nets in Wapogasset and Bear Trap lakes, Polk County, WI, 2013-2014. White bars represent muskellunge of unknown sex, blue bars represent male muskellunge, and orange bars represent female muskellunge.

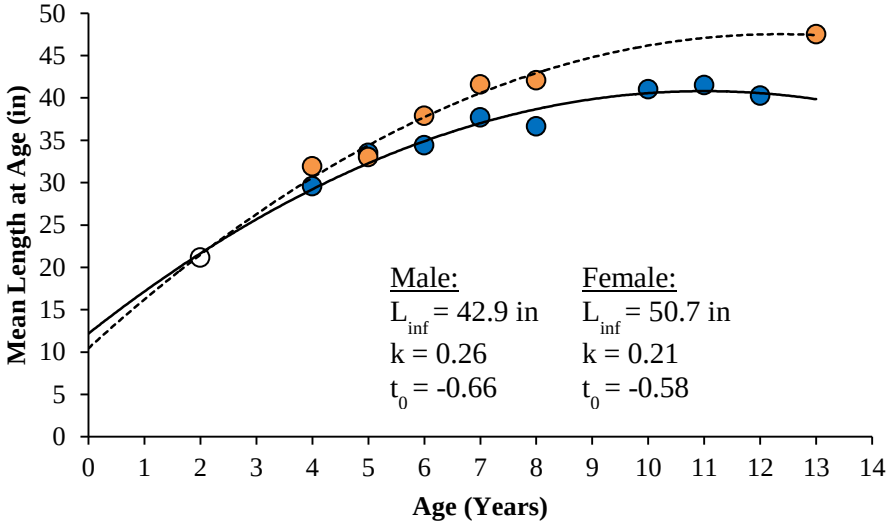

Figure 6. Mean lengths-at-age for female (solid orange circles), male (shaded blue circles), and unknown sex (white circles) muskellunge collected from Wapogasset and Bear Trap lakes, Polk County, WI, 2013. Mean length of age-2 unknown sex muskellunge were included for the growth equations. L_{inf} = theoretical maximum length, k = growth coefficient, and t_0 = time at which length is zero.

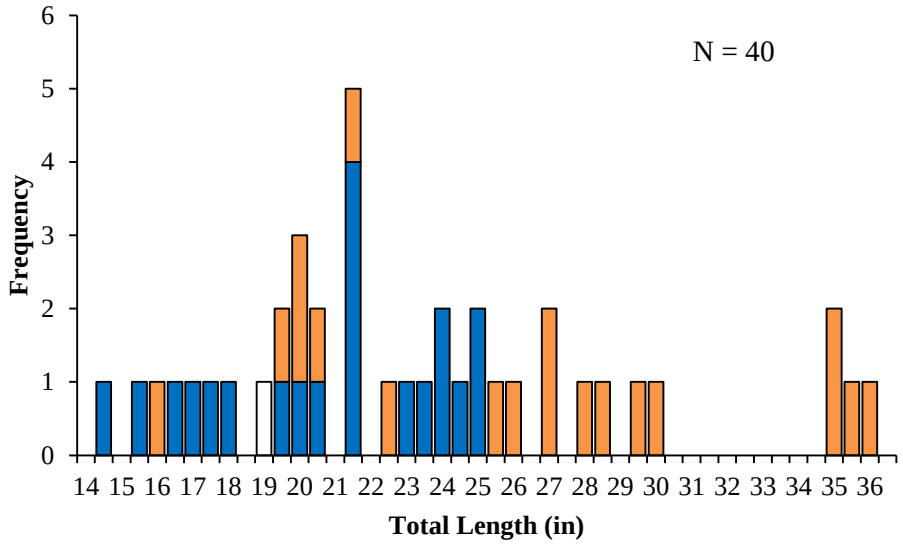

Figure 7. Length frequency histogram for northern pike captured with fyke nets in Wapogasset and Bear Trap lakes, Polk County, WI, 2013. White bars represent northern pike of unknown sex, blue bars represent male northern pike, and orange bars represent female northern pike.

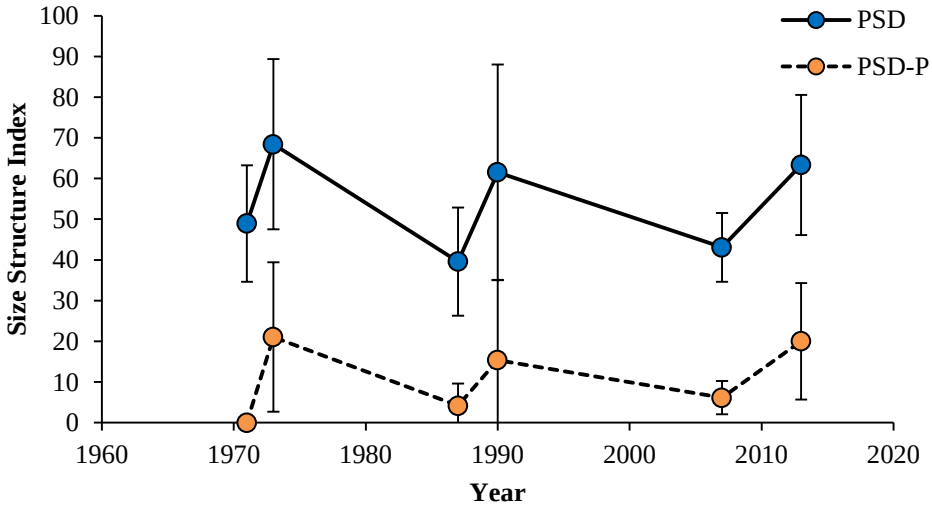

Figure 8. PSD and PSD-P size structure index values (with 95% confidence intervals) for northern pike collected from fyke nets from Wapogasset Lake, Polk County, WI 1971-2013.

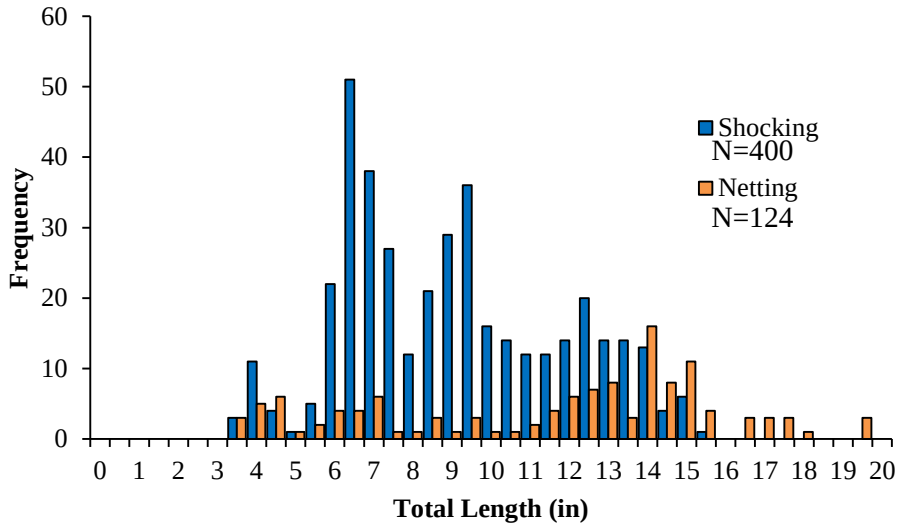

Figure 9. Length frequency histogram for largemouth bass captured during spring fyke netting and the late spring electrofishing in Wapogasset and Bear Trap lakes, Polk County, WI, 2013.

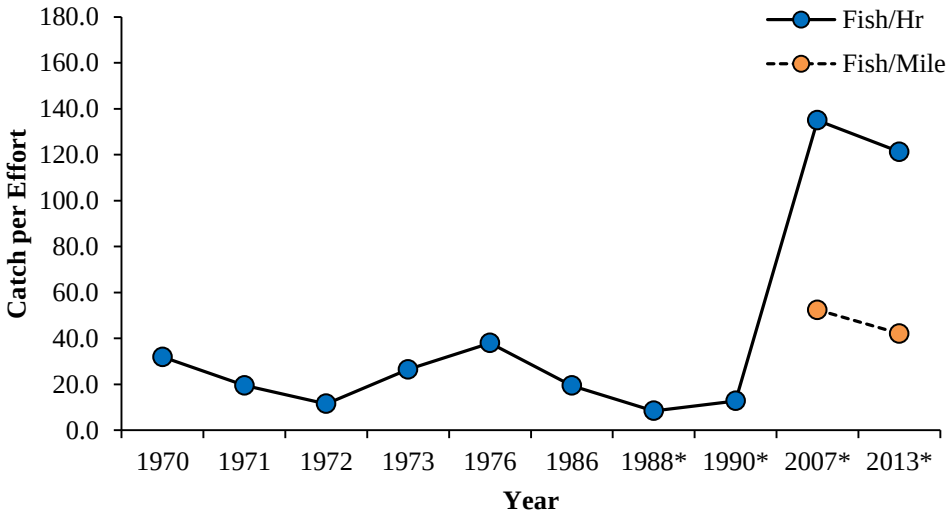

Figure 10. Catch per effort for largemouth bass collected from Wapogasset and Bear Trap lakes, Polk County, WI, 1970-2013. Years marked with an asterisk represent a spring electrofishing survey; all other years were fall surveys.

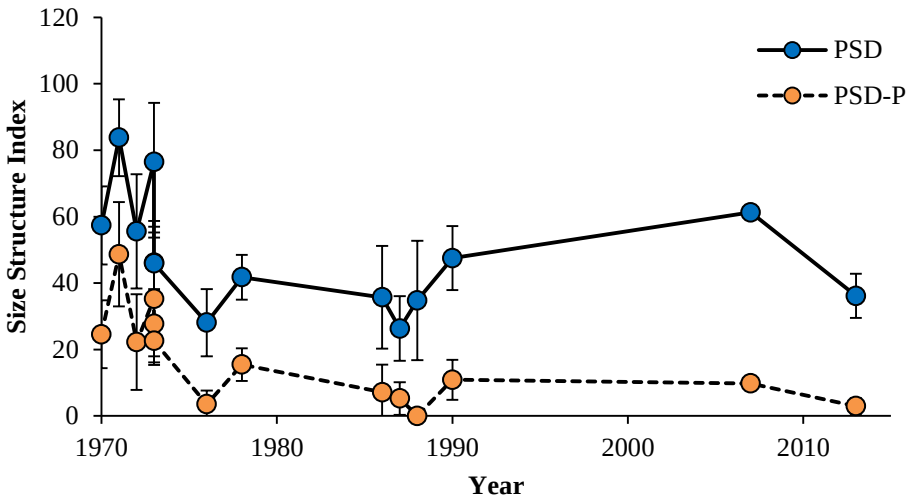

Figure 11. PSD and PSD-P size structure index values (with 95% confidence intervals) for largemouth bass collected electrofishing from Wapogasset Lake, Polk County, WI, 1970-2013.

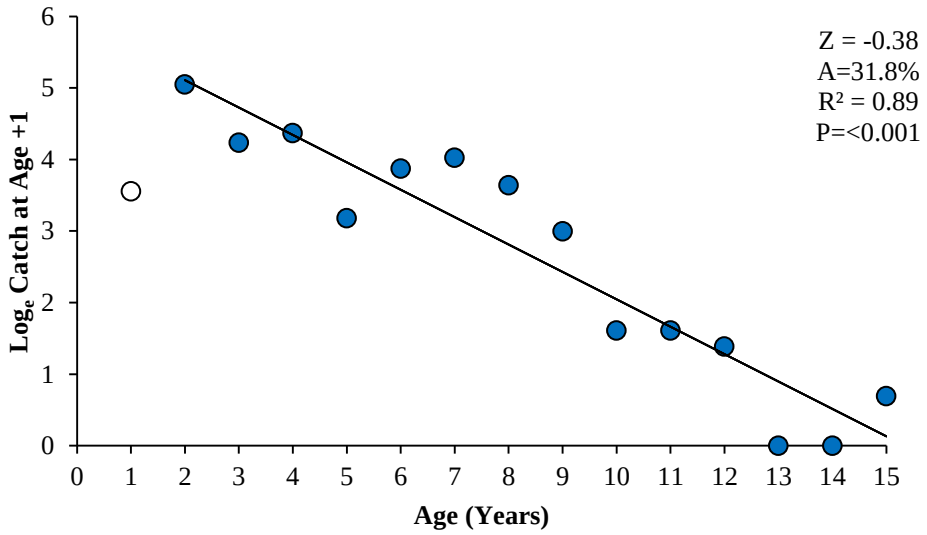

Figure 12. Number at age for largemouth bass collected fyke netting and boom shocking from Wapogasset and Bear Trap lakes, Polk County, WI, 2013. A catch-curve regression estimated instantaneous annual mortality (Z) and total annual mortality (A). Age-1 largemouth bass were omitted from the regression.

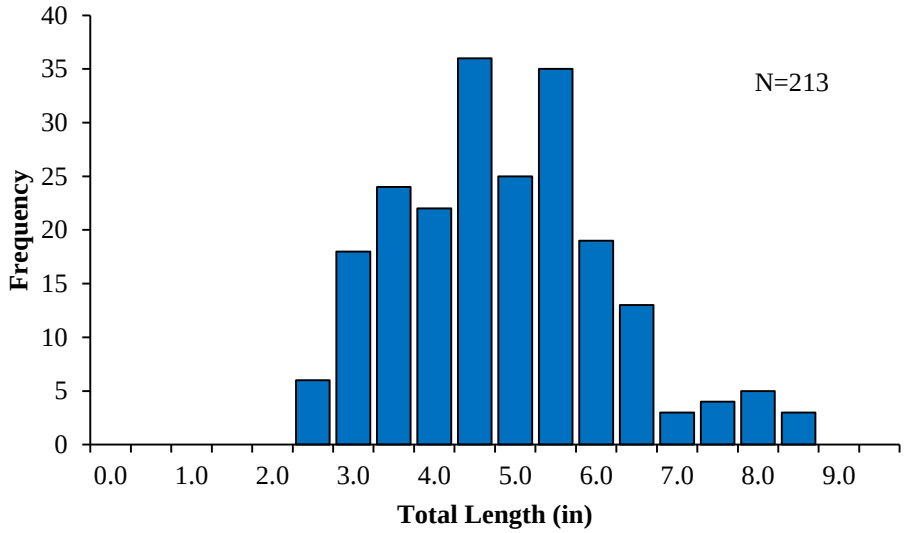

Figure 13. Length frequency histogram for bluegill captured in the late spring electrofishing in Wapogasset and Bear Trap lakes, Polk County, WI, 2013.

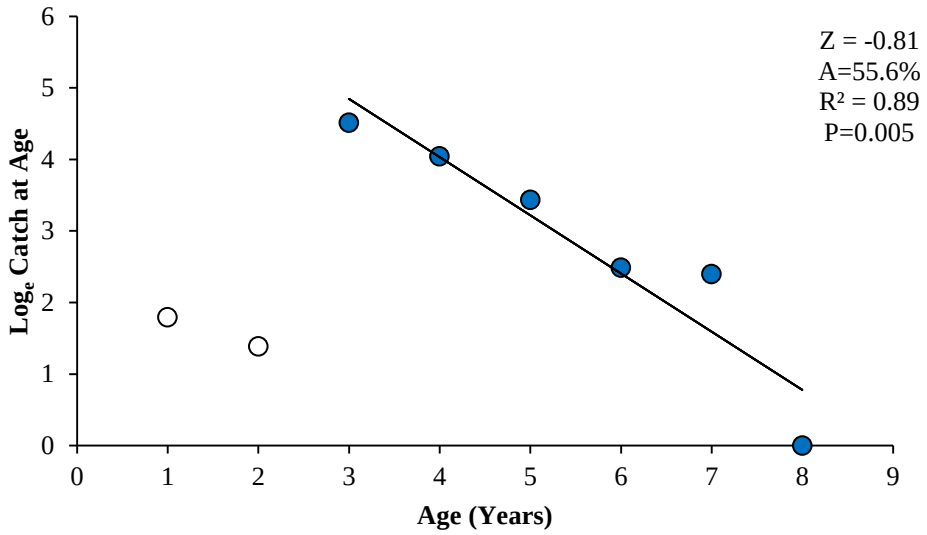

Figure 14. Number at age for bluegill collected during the late spring shocking from Wapogasset and Bear Trap lakes, Polk County, WI, in 2013. A catch-curve regression estimated instantaneous annual mortality (Z) and total annual mortality (A). Age-1 largemouth bass were omitted from the regression.

Appendix Table 1. Length values (in) used in proportional size distribution (PSD) calculations.

Species	Stock	Quality	Preferred	Memorable	Trophy
Bluegill	3	6	8	10	12
Largemouth bass	8	12	15	20	25
Northern Pike	14	21	28	34	44
Muskellunge	20	30	38	42	50
Walleye	10	15	20	25	30